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Increasing Cowpea Productivity Combining Rock Phosphate and Arbuscular Mycorrhizal Fungi Inoculation in Sub-Saharan Africa

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Abstract

Cowpea is a very important crop in sub-Saharan Africa (SSA) as human food due to its high protein content, quality feed for livestock, and it helps to restore soil fertility through nitrogen fixation. However, phosphorous (P) deficiency remains a serious problem to cowpea production. Our study focused on the use of indigenous rock P due to its affordability. We inoculated cowpea with *Glomus intraradices* as arbuscular mycorrhizal fungi (AMF) to promote P uptake from rock P.

Results from pot experiments using low P soil (approx. 1 ppm) from Fashola village in south-western Nigeria showed that the optimum application level of Togolese rock P is 60 mg P kg⁻¹ for cowpea cultivation.

Using 15 cowpea genotypes, the pot test was conducted for verifying the effects of co-application of rock P at 60 mg P kg⁻¹ and AMF inoculation. One of 15 genotypes (Sanzi) showed significantly ($p < 0.05$) higher shoot dry weight (SDW) at 8 weeks after planting (WAP) with AMF co-application than in the treatment of only rock P application. The SDW of other 14 cowpea genotypes were slightly higher than when only rock P was applied. AMF inoculation appears to be ineffective under high soil P condition. Therefore, these results indicated that rock P application at 60 mg P kg⁻¹ is too high for AMF inoculation to work. Optimum application amount of rock P should be less than 60 mg P kg⁻¹.

In another pot test, four levels of rock P application: 0, 20, 40, and 60 mg P kg⁻¹ were established with AMF inoculation using six cowpea genotypes selected from above mentioned nine genotypes. The SDW at 8 WAP showed that 20 mg P kg⁻¹ was the optimum level for cowpea with AMF inoculation.

Additionally, AMF can contribute to increase water as well as P uptake. We observed that AMF inoculation has positive effect on increasing drought tolerance of cowpea. More detailed studies need to be carried out to elucidate the effects of the co-application of rock P and AMF inoculation on cowpea productivity in SSA.

Keywords: Arbuscular mycorrhizal fungi, cowpea, rock phosphate